

#### CLAIMS

- 1 1. Method of analysis of ions by radial or axial mass-to-charge-selective ejection of  
2 ions from an rf quadrupole ion trap consisting of four pole rods, the field having  
3 frequency  $\Omega$ , wherein the ejection of ions is supported by nonlinear resonances set  
4 up by superposition of higher multipole fields.
- 1 2. Method according to Claim 1 wherein the nonlinear resonance is produced by a  
2 superposition of higher "odd" multipole fields, and wherein the nonlinear  
3 resonance at  $\Omega/3$  is used for ejection.
- 1 3. Method according to Claim 2 wherein higher "even" multipole fields are  
2 superimposed simultaneously.
- 1 4. Method according to Claim 1 wherein the higher multipole fields are produced  
2 mechanically by a dislocated arrangement or unsymmetric shaping of the parallel  
3 pole rods.
- 1 5. Method according to Claim 1 wherein the higher "odd" multipole fields are  
2 produced by unequal amplitudes of the driving voltage at opposing pole rods.
- 1 6. Method according to Claim 5 wherein the ratio of the driving voltage amplitudes  
2 at opposing pole rods are adjusted to the scanning rate.
- 1 7. Method according to Claim 1 wherein the higher multipole fields are produced by  
2 a dislocated arrangement of the pole rods and by unequal amplitudes of the  
3 driving voltage at opposing pole rods.
- 1 8. Method according to Claims 1 wherein the ions are brought into nonlinear  
2 resonance by a dipolar excitation field.
- 1 9. Method according to Claim 8 wherein the dipolar excitation field is at the same  
2 frequency as the nonlinear resonance.

- 1 10. Method according to Claim 9 wherein the phase of the dipolar excitation field is  
2 locked to the phase of the frequency of the driving radio frequency voltage, and  
3 wherein the phases are adjustable in relation to one another.
- 1 11. Method according to Claim 1 wherein the ions are ejected radially through a slit in  
2 one of the pole rods.
- 1 12. Method according to Claim 1 wherein the ions are ejected axially through at least  
2 one apertured diaphragm at the end of the rod system.
- 1 13. Method according to Claim 12 wherein a dipolar excitation field is produced by  
2 splitting an apertured diaphragm on the front of the rod system and connecting  
3 one phase each of the excitation voltage to each half of the diaphragm.